

New York State Barge Canal: Gowanus Bay Terminal Pier
(Gowanus Bay Terminal Pier) (Columbia Street Pier)
150 feet east of bulkhead supporting the
southernmost 1,350 feet of Columbia Street
Borough of Brooklyn
Kings County
New York

HAER No. NY-154

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PHOTOGRAPHS

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HISTORIC AMERICAN ENGINEERING RECORD

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Location: 150 feet east of bulkhead supporting the southernmost
1,350 feet of Columbia Street
Borough of Brooklyn, Kings County, New York

UTM: 18,583690.4502040
Quad: Jersey City

Date of Construction: 1917-22; modified 1949-51, 1955-56, and 1967

Engineers: Frank M. Williams, New York State Engineer and
Surveyor (planning and administration of Barge Canal
terminal construction program)

Edward A. Anderberg, Senior Assistant Engineer, New
York Residency (supervision of Gowanus Bay Terminal
contracts)

Original Contractors: Riverside Construction Company, New York, NY
(substructure and deck)
Snare & Trieste, New York, NY (piershed framing,
siding, and cargo masts)
Fegles Construction Company, Minneapolis, MN (grain
handling facilities)
Lambert Hoisting Company, Newark, NJ (semi-portals
cranes)
Geo. Gibson & Co., Inc., New York, NY (piershed
heating)
William Young Plumbing Co., New York, NY (piershed
plumbing)
Thomas E. O'Brian, Inc., New York, NY (piershed
water supply)

Present Owner: The Port Authority of New York and New Jersey
One World Trade Center
New York, New York 10048

Present Occupant
and Use: Northeast corner of pier and adjacent former warm room
area are presently leased by Kosnac Floating Derrick
Company for barge and derrick tie-up and maintenance;
remainder of pier is vacant.

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Significance: The terminal pier is significant as part of the original complex, as an excellent and increasingly rare example of early twentieth century freight pier construction and, through its physical and functional history, as a particularly intense site of attempts to adapt to changing freight handling conditions between 1920 and 1970.

Project Information: This documentation, made for the Army Corps of Engineers New York District between August and November 1985 by the consultants listed below, is a mitigation of adverse effects to the terminal pier anticipated in 1986-87, when it will be removed as part of the New York Harbor Collection and Removal of Drift Project.

Principal researcher
and author: Michael S. Raber
Raber Associates
41 Great Hill Road
Cobalt, Connecticut 06414

Principal
photographer: Thomas R. Flagg
Photo Recording Associates
366 Orchard Terrace
Bogota, New Jersey 07603

Original drawing
copy photography: Speed Graphics
150 East 8th Street
New York, New York 10022

Introduction

The State of New York built the New York State Barge Canal between 1905 and 1922, in a spectacular attempt to regain grain and other through-freight traffic lost by the Erie Canal to railroads after 1880. The barge canal was the greatest inland waterway built in the United States at that time, in size and engineering accomplishment. At the southern end of the system in the Port of New York, the Gowanus Bay terminal, built between 1914 and 1922, was the largest such facility on the system, and the most important as the planned transshipment point between canal barges and ocean-going steamships. The terminal pier and a concrete grain elevator with two million bushels capacity were the principal features of this complex. Together, they made the terminal a superb site for transferring grain from canal barges to steamships via the elevator and the terminal pier, and for transferring other freight from barges to ships through the pier, making it the only terminal ever built in this port capable of loading mixed steamship cargoes of grain and other freight simultaneously from a pier or upland storage area. A grain conveying gallery system from the elevator ended above the east side of the pier, and mobile semi-portal cranes for barge unloading could range along the length of the west side. These handling features made the terminal pier, otherwise a large but typical example of contemporary freight pier construction in the Port of New York, a unique structure in the port. Both structures, with modern grain and freight handling mechanisms selected from a wide range of contemporary American examples by the Office of the New York State Engineer and Surveyor, were typical of barge canal engineering and planning: large in scale, extremely well built, often innovative in design, coherent in economic mission, and fully lacking in adjustment of that mission to contemporary transport economies. The barge canal and its Gowanus Bay terminal failed to meet expected grain or other through-traffic goals. The canal's size precluded ship traffic, requiring transshipment at Buffalo and New York, and limiting any competitive advantage the system might have enjoyed against the railroads. Continued rail dominance of grain traffic sharply reduced the role of the Gowanus Bay terminal elevator, because the barge-oriented terminal had no rail connections. In 1944, the State of New York turned the deficit-ridden complex over to the New York Port Authority, which converted the terminal pier to exclusive use for lighter, break-bulk cargo handling and removed the special grain and barge unloading facilities. The Port Authority also attempted to rationalize the reduced grain handling expectations of the port by redesigning the grain loading system, before deactivating the elevator in 1965 after the complete disappearance of such traffic here. The dominance of container freight handling led to the end of active terminal pier use in the mid 1970s. With both the pier and the elevator extant and substantially intact, this complex and its history exemplify the grandiose but flawed conception of the barge canal project, and the gradual decline of maritime traffic and traditional cargo handling methods in the Port of New York.

Part I: Historical Information

The Barge Canal and Its Terminals

The Gowanus Bay Terminal was one of the last completed components of the New York State Barge Canal system, reflecting the parameters of canal planning in the chronology of its construction and the evolution of its design. Proponents of the Barge Canal, and of other alternative types of new waterways through New York State, hoped to counter the dramatic capture of Erie Canal freight traffic by railroads after 1880. Railroad competition affected the economies of the Erie Canal corridor through the state, and of the Port of New York, with the most important impacts felt in the grain trade as the last century ended. While rail transport of grain did not initially alter the port's share of perhaps half the North American export grain trade, or Buffalo's place as a transshipment point between lake and rail grain transport, several factors reduced the state's role in this trade after 1895. As the great centers of North American grain production moved west and Upper Mississippi Valley commercial agriculture shifted from grain to beef, the importance of the Great Lakes grain route diminished and other ports from Galveston to Philadelphia began actively competing for the export trade. With newer terminal facilities for shiploading full cargoes, these ports offered lower handling charges than the Port of New York, where a lack of adequate shiploading grain terminals and a well established traffic in mixed cargoes continued the need for the added expense of floating grain elevators. Early twentieth century, federally mandated rail rate differentials in favor of Baltimore and Philadelphia cut further into grain traffic through the State and into the Port of New York, as did Montreal's position as the only other major port open to the Atlantic with possible all-water routes to the interior; the Canadian port was also developing extensive new shiploading terminal facilities. Grain handling interests in New York and Buffalo became ardent supporters of a new canal system, while at the same time discouraging any system which might by-pass their transshipment firms. The inconsistency of such support from private terminal operators explains at least in part the Barge Canal's form and the initial lack of planning for public terminals (Baker 1920; Raber, Flagg, Parrott, Henn, Levin, and Wiegand 1984: 104-110).

After a decade of debate on the need for a new canal and the possible forms it might take, New York State voters approved an act calling for a rebuilding of the Erie, Oswego, and Champlain canals in 1903; later acts authorized similar improvements on the Cayuga and Seneca canals, but the 1903 elements remained the major components of the new system (Figure 2). Essentially, the improvements allowed for construction of waterways designed for diesel-powered barges, along routes which maximized the use of natural bodies of water. These conditions meant substantial changes in the nineteenth century canals, which were largely artificial channels designed for boats pulled by mules. The new system, opened in 1918 prior to completion of all terminals, was an engineering achievement of great significance, but the anticipated economic benefits never materialized to offset the expenditure of over 150 million dollars. Barge Canal traffic costs for most types of freight were higher than comparable rail costs on all but through business between Buffalo and New York, while for grain traffic the transshipment and elevating costs, and other handling and terminal facility conditions along this route, made reversal of the trend towards rail routing of grain to other ports impossible. Construction of a ship canal accommodating vessels large enough to preclude transshipment at Buffalo or New York was opposed not only by private terminal operators, but by canal planners who compared barge and ship freight costs without much consideration

of the rail rates which were the real target of the entire canal construction movement (see Baker 1920 for discussion of other problems in canal and terminal transport economies; for Barge Canal engineering and planning, see Whitford 1922 and summaries in Raber, Leary, et al. 1983: 158-69).

There was little attention paid to terminals during the early years of canal construction, and formal study of this issue did not even begin before 1909. A commission established in that year to assess the need for terminals concluded that public management of such facilities was essential. Private waterfront terminal management, represented most prominently by railroads, was inconsistent or actively hostile to canal traffic. The terminal commission attributed some of the decline in through canal traffic after 1870 to a lack of terminal facilities at Oswego, Buffalo, and the Port of New York which made for uncompetitive transshipment at these points. Despite a decline of about 80 percent in through traffic, however, the volume of local canal traffic remained steady during the same period. To maintain the existing strengths of the state's waterways and to address outstanding inadequacies, then, the terminal commission in 1911 recommended a large number of state-built terminals at most towns and cities along the routes, and at the principal ports connected to the system. The state eventually built fifty-six terminals, including eight at the Port of New York, at about forty-two towns and cities. Terminal construction often lagged some years behind the 1918 opening of the waterway proper. Most of the canal terminals were marginal wharves (landing places parallel to a canal) with freight sheds and freight transfer handling equipment. Piers replaced such wharves only at the major transshipment terminals in Buffalo, Oswego, and New York City (Whitford 1922: 173-99, 275-88).

There were very few American examples c1910 of large public water terminals with mechanical handling facilities suitable for the anticipated canal traffic. Despite two federal studies and the Barge Canal Terminal Commission's work at this time, American port designers and engineers did not really begin intensive work on terminal problems until the sudden demands of World War I created severe bottlenecks at the nation's Atlantic ports, resulting in a construction program of Army supply bases followed by other post-war terminals also concentrating on transfers of rail and ship traffic. Under Frank Williams, the New York State State Engineer and Surveyor most responsible for terminal design and construction, canal planners studied more canal-oriented European public terminal arrangements, and mechanical handling equipment used in American ports. Lack of existing terminal models and the need for studies in innovation, together with debate over the need and funding for different types of Barge Canal terminal facilities, resulted in major changes in some terminal designs after the initial act authorizing terminal construction in 1911. Grain elevators, along with coal transfer stations, were the most notable features not anticipated during the first years of terminal construction. Despite the recognition that grain facilities were necessary to compete with Montreal, and that existing facilities in Buffalo and the Port of New York were generally inaccessible to canal traffic because of hostile railroad policies, debate on possible Barge Canal grain elevators did not begin in earnest until American entry into World War I focussed attention on the need to supply Allied forces. By that time, terminal construction at Gowanus Bay had been underway for several years, and plans made for the Terminal Pier. The addition of grain elevators to the Barge Canal system under a 1920 authorization therefore involved adding new facilities to existing or partially completed terminals (State of New York 1917, 1918, 1921; Whitford 1922: 203-5; Raber, Flagg, Henn, Levin, and Wiegand 1985: 75).

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The principal targets of Barge Canal proponents--Montreal and the railroads--are apparent in the final decisions made regarding grain elevators. Although Buffalo was a major grain transshipment point, with some twenty-three elevators in this period, a water route for export grain via Lake Ontario, Oswego, and the Barge Canal south and east of Oswego appeared shorter and cheaper than a comparable route through Buffalo. In a period of diminishing enthusiasm for funding Barge Canal projects, after fifteen years of construction, the state authorized elevators only at Oswego and New York City. The Gowanus Bay elevator was thus one of only two on the Barge Canal system, and at a cost of nearly two million dollars was the single most expensive terminal structure when completed in 1922 (Whitford 1922: 203-8, 568-74).

The Gowanus Bay Terminal Site

Evolving plans for the Gowanus Bay Terminal between 1913 and 1920 did not alter its most essential function--unique on the Barge Canal system--of loading transoceanic steamships. It was the only terminal with sufficient dredged depths and equipment to make such transfers, and principally because of its function was the largest terminal, with the largest covered pier, on the system. Selection of the shiploading terminal site was a critical step in achieving the state's canal traffic objectives, a step which as taken ultimately proved inimical to canal operations: the Gowanus Bay site lacked rail connections, as did several other canal terminals in the Port of New York. With railroads and other private terminal companies controlling so much of the port's waterfront served by rail, the state had to use undeveloped areas for about half the New York City terminals, some of them far from existing rail lines. The size of the anticipated shiploading terminal exacerbated the location problem, since the state originally hoped to build upland warehouse facilities and a rail classification yard, and virtually all areas in the city large enough to accommodate such a site were far, in 1911, from trunk line connections with or without lighterage.

The state purchased about fifty acres of undeveloped intertidal land and water for the terminal on the north side of Gowanus Bay by 1914, immediately east of Erie Basin. Site selection followed Barge Canal Terminal Commission recommendations, which in turn followed closely part of a plan by the New York City Department of Docks and Ferries to 'municipalize' the South Brooklyn waterfront, reproducing the city's model of two large piers with freight sheds or warehouses on an artificial upland. An alternate, more developed site across Gowanus Bay offered less access for large ships. The terminal site chosen was the north part of an area known as Brooklyn Basin, originally proposed for private development of breakwaters, warehouses, and other private transshipment facilities in the 1850s and 1860s by prominent Brooklyn merchants and building contractor William Beard, during a period of tremendous growth in Brooklyn waterfront development. These men abandoned the Brooklyn Basin project by the early 1880s as railroads centered in Jersey City and Manhattan captured an increasing share of Port of New York traffic, but they completed most of Erie Basin between 1856 and 1880 while the Brooklyn boom continued. By 1910, Brooklyn Basin, held by Beard's estate, had the remains of his cribwork originally intended to retain wide breakwaters, behind which the shallow waters served as a graveyard for dismantled vessels and as a spar yard or timber dock (Figures 3 and 4; Morris 1920: 448; Staniford and Guise 1912; Raber, Flagg, Parrott, Henn, Levin, and Wiegand 1984: 30-1, 64).

Terminal Design and Construction

The Office of the State Engineer and Surveyor designed all terminal structures, using either state employees or consultants hired to address special problems. Data reviewed for this documentation revealed relatively little about individual design and engineering responsibilities. Frank M. Williams headed this office in 1909 and 1910, during which time he also headed the Barge Canal Terminal Commission, and again from 1915 through completion of most terminal construction in 1922. He was probably most responsible for overall planning for the Barge Canal terminals in general, and for the Gowanus Bay Terminal -- built almost entirely during his second term of office -- in particular. Edward A. Anderberg, Senior Assistant Engineer in charge of the New York Residency, supervised most Gowanus Bay Terminal construction, all of which was done by private contractors working to state specifications. Prominent consultants in waterfront structures and terminal designs worked for Williams' office during most years of Gowanus Bay Terminal construction, but their individual contributions remain undocumented.¹ These consultants included B.F. Cresson, Jr., a former New York City Deputy Commissioner of Docks active during the same period as a chief advisor to the program of Army Supply Base construction. Harry R. Wait, consultant and apparently chief designer of the two Barge Canal grain elevator, is the only individual whose plans can be directly associated with a structure at the Gowanus Bay Terminal (Whitford 1922: 444-53; MacElwee 1926: 167-8, 379-81; State of New York 1921 [plans]).

Terminal construction between 1914 and 1925 proceeded through four basic, somewhat overlapping stages: dredging with bulkhead and upland construction; pier substructure and deck construction; freight handling superstructures and machinery; and grain handling facilities. As completed, the complex cost nearly 6 million dollars exclusive of land and legal costs, with the Terminal Pier and its equipment costing about 1.154 million and the grain facilities about another 2 million. With the exception of freight handling machinery, the first three stages included bulkhead and pier designs generally typical of contemporary waterfront construction in the Port of New York. Most contracts for work on these three stages, apparently awarded on a low bid basis, went to firms from this region. Only the construction of grain handling facilities included a more distantly headquartered contractor, probably consistent with the non-local design and construction problems noted below (State of New York 1910-1944 [primary sources], 1914-26; Williams 1920; Whitford 1922: 568-74).

Bulkhead and Upland

From about June 1914 to June 1917, terminal work under contract to George W. Rogers & Co., Inc., began as a project to create a marginal wharf with some thirty acres of upland and an adjacent water area of sufficient depth for steamships. This contract included removing wood debris from Brooklyn Basin, dredging a channel thirty-five feet deep along the project bulkhead line, building a bulkhead 700 feet long east of Columbia Street, and filling behind the bulkhead with the dredged material. The bulkhead built under this contract apparently consisted of vertical face concrete blocks about 9.5 feet high, with 2 foot wide tops and bases about 5 feet wide, resting at mean low

¹Only names of state employees (confirmed in Whitford 1922: 575-84) appear on surviving Terminal Pier drawings, all of which were reviewed for this documentation, and on surviving design computations for New York City terminal contracts (State of New York 1910-1944: Box 1 [primary sources]).

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water on the outer end of a 20 foot wide, wood plank deck supported by wood pile caps and piles.¹ Wood sheet piling below the inland end of the platform, along with the concrete block, retained solid fill. This relieving platform type of construction, featuring a permanently submerged wooden substructure highly resistant to both fire and decay in waters free of marine borers, first developed in New York City under the Department of Docks during the 1870s and 1880s and became important in regional private construction very early in the twentieth century (State of New York 1915-18; Williams 1920: Plate 148; Whitford 1922: 280; see discussion in Raber, Flagg, Antici, and Wiegand 1984: 70-2).

Later work on the terminal bulkhead and upland included asphalt paving of the solid fill, begun in 1919 by the Asphalt Construction Company to give the upland a finished elevation of five feet above mean high water, and construction of incompletely documented timber and concrete deck structures between c1919 and 1922 which gave the finished complex about 960 feet of bulkhead east of Columbia Street and about 1445 feet running north to Bay Street. Columbia Street to the west (extended by the Beard Estate behind its Erie Basin property), other local streets to the north, a federal pierhead line to the south, and a 200 foot wide slip known as Henry Street Basin to the east (apparently dredged during the first terminal contract) formed the original bounds of the terminal (Figures 4-6; Raber, Flagg, Parrott, Henn, Levin, and Wiegand 1984: 113-17).

Pier Locations, Substructures and Decks

Original Gowanus Bay Terminal plans, made some years before public and private agitation for a grain elevator began in earnest after American entry into World War I, called for two large covered piers, each about 1200 by 150 feet, extending south from the concrete bulkhead built under the first terminal contract outlined above. Barge Canal engineers originally intended both piers for similar or identical purposes of non-grain freight transfers between barges and ships, although later they planned the easternmost pier as a grain unloading facility. The state built only the westernmost of the two, which became the Terminal Pier (Figure 3; State of New York 1911: 172; 1922:11)

After studies for pier design and mechanical equipment in 1916, the Office of the State Engineer and Surveyor contracted with the Riverside Construction Company in 1917 for construction of the Terminal Pier substructure and deck. The contractor began what was intended as a two year job in October 1917, to a design detailed in Part II below. Principal elements included an all concrete deck supported directly on tenoned wood pile heads clamped with transverse timbers, and concrete pedestals on wood piles to support future piershed columns and a crane track. Pier design followed closely plans first developed by New York City's Department of Docks and Ferries c1909 in the 'Gowanus Section'

¹Some bulkhead and pier construction details noted in a preliminary report on this terminal are incorrect, and conflict with revised descriptions given here (Raber, Flagg, Parrott, Henn, Levin, and Wiegand 1984: 113-16).

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of municipal development, on the south side of Gowanus Bay between 28th and 36th streets in South Brooklyn, and subsequently used extensively in regional public and private projects for about half a century (City of New York 1910; Staniford and Guise 1912; Staniford 1914; State of New York 1902-21: Terminal Contract 55 [primary sources]; Raber, Flagq, Wiegand, and Antici 1984: 65-72).

Riverside Construction completed its pier contract over a year late, in November 1920. In its defense, the company cited obstructions of the work area by Army and Navy vessels using the east end of the concrete bulkhead during the war, a city-wide strike of construction for about two months following the Armistice, and repeated problems with vessels using the partially completed structure for unauthorized temporary wharfage, a practice which impeded delivery of construction materials and seriously damaged the pier in at least two cases of collision. The contractor quietly collected wharfage fees from the private vessels using the pier, suggesting the common and widespread nature of this problem in the port (State of New York 1902-1921: Terminal Contract 55 [primary sources]).

In 1918, before the Terminal Pier substructure and deck were completed, the Navy built a temporary, uncovered all wood pier, 700 by 14 feet, at the south end of the completed concrete bulkhead as part of a wartime coaling station. The latter structure, shown in Figure 6, remained in place until about 1949 as a permanent part of the terminal, pre-empting the site originally intended for the second covered terminal pier. The failure of the state to complete the original pier plan, while unexplained in all data reviewed for this documentation, probably resulted from both diminishing financial support for Barge Canal construction after c1920, and from the realization that barges tied up or laid over near the grain elevator were sometimes so numerous as to preclude use of a second shiploading pier by ships (State of New York 1902-1921: Terminal Contract 55 [primary sources]).

Freight Sheds and Handling Equipment

Despite a very low level of traffic on the newly opened Barge Canal and the delayed completion of the Terminal Pier substructure and deck, by 1919 state canal planners were anxious to provide freight storage facilities at Gowanus Bay. Encouraging canal traffic obviously required providing such facilities. In addition, Port of New York congestion during and immediately after World War I made the relatively extensive new bulkhead space at the terminal a desirable location for non-canal traffic, from which the state could collect fees. In lieu of the awaited Terminal Pier shed, then, the state contracted with J.A. Laporte in April 1919 for erection of a temporary 1 1/2 story frame freight shed, 190 x 50 feet, immediately behind the bulkhead between the Terminal Pier and the 'Navy Pier'. Laporte evidently completed this structure, which remained in place several years after the Terminal pier shed was finished in 1922, as soon as the paving contractor moved his work far enough inland. The temporary shed had no equipment. There is probably no surviving information on the history of its use (Figure 6; State of New York 1920: 18; Whitford 1922: 568-74).

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State engineers began planning for the Terminal Pier shed in 1915-16, shortly before increased demands by canal proponents for grain facilities. By the time Snare & Trieste Co. began work on the shed construction contract in October 1920, however, the state legislature authorized grain elevator construction. State Engineer and Surveyor Williams, a prominent campaigner for grain facilities, had anticipated the authorization by including in at least later versions of terminal plans a grain conveying and shiploading system ending on the pier (State of New York 1920: 14-15).

The Terminal Pier was thus designed for two entirely different purposes: movement of freight across the pier between barges and ships, and movement of grain from a nearby elevator to ships docked at the pier. The former type of movement involved traffic flow along the width or transverse axis of the pier. Longitudinal movements inside the shed were part of this process, to accommodate different locations of doors through which items entered, were stored in, and left the shed. The grain delivery function of the pier involved only movement above the east side of the pier in a conveyor gallery (Figure 6). The dual purpose shed was thus designed with a capability to load ships simultaneously with grain and other freight, thereby accommodating both the potential for full cargo grain traffic and the reality of the mixed cargo shipping which was far more important in the Port of New York: the grain gallery could also load barges for delivery to ships elsewhere in the port. The concept of loading ships with grain in this way, as opposed to bringing ships directly alongside grain elevators, had been used for terminals built c1910-18 in Boston and, especially, Montreal. Both these ports had to address problems of mixed or full cargoes, similar to those of New York, in the face of rail rate advantages enjoyed by Philadelphia and Baltimore. At these latter ports, where full cargoes were the rule, ships loaded alongside elevators (Photographs 11-14; New York, New Jersey Port and Harbor Development Commission 1920: 416-17).

Because of the authorization and funding history of the Gowanus Bay Terminal, and because of the state's frequent use of direct contracts for even component elements of larger Barge Canal structures, final plans and contracts for Terminal Pier superstructure and related handling equipment progressed in a piecemeal and ultimately incomplete manner between 1920 and 1922 or 1923. In addition to installation of heating and water supply facilities in the shed after completion of major structural and side wall elements, there were three distinct phases of construction: the shed proper and its cargo masts, built between October 1920 and about June 1921; two semi-portal cranes installed on the shed's west side around November 1921; and the grain gallery, installed on the shed's east side behind the cargo masts by August 1922. Discussion of the latter appears below with other terminal grain facilities, and in more detail in section II. Funding restrictions eliminated other planned equipment inside the shed such as truck scales and longitudinally traveling cranes, while similar restrictions and the lack of any rail connections eliminated the tracks originally planned for the wide west apron (Figure 7, Photographs 16, 22; State of New York 1922: 42, 1923: 21-24; State of New York 1910-1944: Box 39 [primary sources]).

The Snare & Trieste contract called for erection of a one story steel framed shed with corrugated iron siding, 1184 by 108 feet, with vertical lift cargo doors, asphalt paving over the concrete deck, and cargo masts running along the entire length of the west roof edge (Photograph 1). The masts supported pulley blocks used with ships' booms for loading and unloading (see Part II).

The cargo mast system was designed for future use in supporting part of the grain gallery, as shown in Figure 5 and discussed in Section II. With the partial exception of a two story headhouse with utility and office space at the north end, not always seen in general cargo or lighterage piers, the Terminal Pier superstructure design followed a pattern common in the Port of New York from the very beginning of the twentieth century; cargo masts became widespread by World War I (Raber, Flag, Wiegand, and Antici 1984: 83-86).

The extensive use of mechanical freight moving equipment in much Barge Canal terminal construction was unusual relative to many American water terminals. The Port of New York generally lacked such equipment, although the extensive use of cargo masts, and the port's equipment for coal and flaxseed traffic by this time, belie somewhat the reputation for undeveloped methods. At Gowanus Bay, as well as at Port of New York Barge Canal terminals at Pier 6 East River, Pier 93 North River, and Greenpoint, canal designers chose three ton, traveling, semi-portal, revolving jib cranes. Single rails set in the pier apron deck and on the side of the shed supported each crane. These cranes were intended to move freight from barges into piersheds, with the preferred movement being directly from a barge through the nearest piershed door. Terminal Pier design originally included a girder-hung crane in each longitudinal bay for additional cargo movement, equipment which was never installed. In the absence of the two interior cranes, pier operators had the semi-portal cranes travel along the pier side with heavy loads, a practice which seriously damaged the crane motors at least once (Figure 7, Photographs 16, 24-25; New York City Department of Docks and Ferries 1912; State of New York 1902-1921: Terminal Contract 118 [primary sources]; MacElwee 1926:138-9).

Terminal Grain Facilities¹

State contractors completed most terminal grain facilities between about November 1920 and August 1922, in two phases. The Raymond Concrete Pile Company built the elevator foundations, and related concrete and timber bulkheads on the east side of the terminal, by about the middle of 1921. Beginning in the fall of that year, the Fegles Construction Company erected most elevator components, and the grain conveying system which ended on the Terminal Pier. The elevator foundations and superstructure were based on contemporary designs of American grain facilities in marine situations, derived principally from midwestern American practice. The foundations consisted of a 3.5 foot concrete mat on a dense array of wood piles. An all concrete structure about 430 by 70 feet, the elevator could hold about two million bushels in 54 circular bins 20 feet in diameter, 37 quarter bins surrounding the circular bins, and 34 inner bins among the circular bins, with the entire bin array 95 feet high below garner, scale hoppers, and equipment for horizontal and vertical grain movement. There were facilities for drying and cleaning grain, in two separate houses attached to the south and southeast sides of the elevator, respectively. Aside from undocumented pneumatic equipment, installed on the bulkhead in

¹Detailed description of the all the grain facilities installed at Gowanus Bay exceeds the scope of this documentation, and the discussion here focusses on planned and completed grain flows through the entire terminal rather than grain processing and handling within the elevator. For more information on this impressive structure, see State of New York 1923: 24-26; State of New York 1921 [plans]; and Raber, Flagg, Parrott, Henn, Levin, and Wiegand 1984: 116-20.

1923 south of the elevator for direct delivery of salvage grain from barges to the drying house, all equipment in the electrically powered system for vertical or horizontal grain movement featured endless belt conveyors, with chain or rope transmissions, common in late nineteenth century designs. The state thus used the most current types of concrete elevator construction while avoiding the higher operating costs of newer, pneumatic conveying equipment. Design origins are also reflected in the selection of contractors: Raymond Concrete Pile Company was a local firm capable of building specialized marine substructures; Fegles Construction Company from Minneapolis probably had expertise in concrete elevator work not available locally, and astonished the engineering community by pouring the entire bin structure as a monolith in thirteen days (Figure 6; Ketchum 1907; Engineering News-Record 1921; State of New York 1921 [plans]; Whitford 1922: 568-74; State of New York 1924: 15; Army Corps of Engineers 1926).

As completed, terminal grain facilities allowed for unloading barges alongside the elevator in the Henry Street Basin to the east, through two marine legs in towers. A third tower, at the northeast corner of the elevator, was never equipped for operation. State engineers planned for additional, pneumatic unloading facilities, on a second terminal pier built south of the elevator, and designed the grain loading conveyor described below to accommodate the addition, but after 1922 no mention of this pier appears in official plans. The elevator allowed for three types of loading: into barges or lighters in the Henry Street Basin through spouts on the east side of the elevator; through spouts into trucks on the northwest side; and into ships, barges, or lighters on the east side of the terminal pier through over 2200 feet of conveyor galleries. Plans to create railroad car loading facilities, on the west side of the elevator beneath the first of the galleries, never materialized in the absence of any rail connections to the terminal (State of New York 1922: 11; 1926: 12).

The grain conveyor system leading to the Terminal Pier was a large scale application of standard belt conveyor and elevating grain leg technology, with six distinct components: four different elevated galleries and two towers moved grain to the pier and raised it to a height sufficient for shiploading. On the southwest side of the elevator, the conveyors began in Gallery A, a two story, steel framed and iron sided structure about 15 feet wide, elevated 25 feet above the terminal pavement on steel supports. Gallery A was about 240 feet long, and ran into a steel framed, concrete tower about 110 feet high and 25 feet square, located off the southwest corner of the elevator. As planned, each story in Gallery A was to contain two belt conveyors, each 42 inches wide, running in parallel. The upper pair was to deliver grain to the elevator from the unbuilt grain unloading pier, while the completed lower conveyors brought grain from the elevator to the tower, where it transferred to Gallery B in an undocumented fashion. Gallery B, perpendicular to Gallery A but at the same height, ran about 480 feet to a second tower about 250 feet north of the Terminal Pier and in line with the pier's east edge. Electrically powered elevating legs in the second tower lofted grain from reserve bins to Gallery C about 75 feet above the ground, a vertical movement of about 50 feet. Galleries C and D were actually a continuous structure running 950 feet out onto the Terminal Pier, with D beginning at the north end of the pier. Spouts from Gallery D could load ships or barges alongside the pier. Part II includes a description of Gallery D and its relationship to the cargo masts (Figures 6-7; Photographs 11-14; State of New York 1923: 24-26).

Additional Terminal Facilities, 1922-1925

The account for completion of the Gowanus Bay Terminal had a positive balance through at least the end of 1924, and canal proponents hoped to add final grain handling features noted above along with completion of other projects. Absence of traffic and growing legislative disinclination to fund more Barge Canal construction restricted such steps. Between the official opening of the terminal on September 1, 1922 and the end of 1925, the Office of the State Engineer and Surveyor finished the following projects: completing the paving of the terminal upland; fencing the terminal; adding a dust collecting system to the grain elevator and improvements to the lofting systems in the two activated marine towers; installing the pneumatic unloading equipment for the drier; constructing a brick administration building or "welfare house" with a machine shop west of the elevator, to serve terminal employees; installing lifting magnets (probably on the semi-portals cranes); and possibly installing a twenty ton truck scale somewhere on the pier (State of New York 1914-1926).

Terminal Operations under the State of New York, 1922-1944

During its first ten years of operation, the Gowanus Bay Terminal handled on average perhaps ten million bushels of grain per year, less than ten percent of Port of New York grain traffic in a period featuring tremendous Canadian exports.¹ This figure suggests relatively little grain traffic materialized at the terminal, or on the Barge Canal generally. Without rail connections, the shiploading and grain terminal could not seriously alter grain traffic patterns to or within the port, even after the state halved elevation charges. The railroads had to follow suit, making some of their grain facilities increasingly unprofitable, but they continued to bring in some of the port's grain and fought canal traffic by excluding lighterage costs to the canal elevator from their grain export rates. The grain terminal did not reverse the port's shiploading limitations, then, in part also because the completed shiploading system was not very large: only one side of the pier was available for this purpose. During a period of increased grain traffic, the State of New York did not complete a grain terminal large enough, and with sufficient upland and harbor traffic links, to make much difference in Atlantic grain export patterns (New York, New Jersey Port and Harbor Development Commission 1920: 417; MacElwee 1926:374-90; Port of New York Authority 1944-46 [primary sources]; Anonymous n.d.).

As long as Barge Canal traffic in general was increasing, albeit slowly, prior to the Great Depression, state canal managers did not publicly lament too strongly the continuing financial liability of the system. Construction and operating costs exceeded revenues for the system as a whole, and for most of the larger terminal facilities. The technical, and related fiscal, deficiencies of the Gowanus Bay Terminal became an increasing matter of concern after 1931. Greater competition from other facilities, continuing rail differentials favoring other ports, and Depression impacts on trade patterns caused a steady drop in terminal grain traffic until World War II. Albany's 1932 completion of the largest grain elevator in the eastern United States intercepted both rail and canal traffic headed for the Port of New York, relegating

¹The most available source on grain traffic at the terminal is very inconsistent on reporting volume, making more detailed analysis difficult without far more primary research (State of New York 1923-1945).

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much port grain handling to topping off nearly full vessels. At about the same time, Canada imposed a high duty on its grain shipped through the United States, removing the principal source of the port's grain exports. By 1933, the port's total volume of grain handled probably did not exceed fifteen million bushels. Ironically, the new grain traffic patterns -- which favored Canadian over New York State canals -- eventually made the smaller Barge Canal elevator at Oswego, on Lake Ontario, profitable as a center for local grain distribution as traffic tended to move through Lake Erie en route to Montreal or Albany. This minor silver lining aside, however, Barge Canal administrators noted by 1935 that west to east grain traffic, once viewed as the principal canal business, was secondary to petroleum shipments (State of New York 1932: 35; 1934: 24-25; 1936: 7, 21-22; 1939: 9; Anonymous n.d.).

Increasingly negative developments made for much harder looks at Barge Canal terminal properties by state administrators, who were now Department of Public Works managers rather than engineers who had urged and planned the system's construction.¹ By 1933, the Superintendent of Public Works recommended selling off "useless canal terminals," especially those at New York City where mooring of inactive barges obstructed other traffic. The Department of Public Works was not then calling for sale of the Gowanus Bay Terminal, however, in part because the elevator was still regarded as the crowning structure of the Barge Canal,² and in part because non-grain traffic at the terminal yielded revenues to the state. The state leased part of the Terminal Pier to the Garcia Diaz Company, a stevedore concern, from about the time the pier shed was completed for general cargo handling in 1921 until 1941. Garcia Diaz use of the pier remains undocumented, but given diminishing canal traffic the firm probably concentrated on general cargo handling for non-canal barge and lighter connections with steamships, a pattern typical of the port. The lease yielded the state about \$655,000 above pier operating expenses over its life. Despite this revenue, by 1939 the increasing liability of operating the elevator convinced the Department that it was time to sell the terminal, although all of the New York City terminals remained in state hands until 1944 (State of New York 1934: 17; 1940: 10; 1942: 8).

Official ambivalence about the terminal through the 1930s was manifested in the limited improvements made to the complex, and eventually in the transfer of about half the undeveloped upland to the federal government for use in Red Hook public housing plans c1938. These plans resulted in filling about 580 feet of the Henry Street Basin, and developing the former land and water terminal areas as the Red Hook Recreational Center (Figure 6). Maintenance and repairs to the terminal complex, aside from dredging conducted in 1928 and 1931, included undocumented repairs (probably to substructures) at the Terminal Pier and the smaller 'Navy Pier', minor plumbing repairs at the Terminal Pier in 1930, and addition of skylight screens at the Terminal Pier in 1931 (State of New York 1924-1931: Maintenance Contracts 38, 41, 65, 67, 70, and 71 [primary sources]).

¹The state abolished the Office of the State Engineer and Surveyor in 1926, incorporating its functions into the Department of Public Works and effectively ending the period of canal construction.

²In 1923, the Superintendent of Public Works -- responsible for administration but not yet construction -- described the completion of the elevator as "...an event second in importance to the finishing of the Barge Canal itself" (State of New York 1923: 42).

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World War II created a brief flurry of new business at the terminal, along with military management, giving state administrators pause before the final disposal of the property. Blockades and reduced shipping early in the war filled even the Gowanus Bay elevator in 1940, and Army handling of grain for war supplies in 1941 and 1942 made grain traffic here profitable before a collapse of this artificial business during 1943. The state made minor repairs to the elevator exterior in 1942, probably in response to the traffic surge but perhaps in part to make the complex more attractive as a property to be taken over by the Port of New York Authority. By the time the transfer occurred on May 1, 1944, the terminal had been under varying types of military management for two to three years. The Army took over the Terminal Pier in 1941, initially operating it through permit to an unidentified shipping company for Lend-Lease traffic. A later lease of the pier to Todd Shipyards Corporation for ship repairs under contracts to the Navy and the War Shipping Administration, noted only in Port Authority files, may have begun prior to 1944. The Coast Guard used much of the terminal, at least during 1942, and erected a number of temporary structures (State of New York 1941: 8; 1942: 8; 1943: 3, 33-36; Port of New York 1944-46 [primary sources]).

It was clear to anyone contemplating use of the Gowanus Bay Terminal by 1944 that both maintenance and rebuilding would be needed to counter the state's relative physical neglect of the complex, and the realities of grain and freight traffic in the Port of New York. As an incentive for the Port Authority to attempt such reorganization, the state loaned the authority 1.15 million dollars from the State Post War Public Works Reserve, a fund set up to finance conversions to peacetime use. At the same time the state transferred the complex to the Port Authority under this arrangement--basically paying for lifting of a longtime fiscal liability--the City of New York received the other local terminals, apparently with no such funds (State of New York 1945: 76; Port of New York Authority 1944-46 [primary sources]).

Terminal Reorganization and Alteration under the Port Authority, 1944-1951

The Port Authority took two basic and immediate steps in managing the re-named Port Authority Grain Terminal: extensive repairs of the Terminal Pier and the grain elevator; and planning and construction of a new grain loading system. The former program, executed primarily between 1944 and 1946, involved mostly in-kind repairs. Work on the Terminal Pier through 1946 included work on most or all of the cargo doors, replacement of the metal exterior walls, painting of the interior, reconditioning of the shed column bases, and repairs to piles, fenders, headhouse stairs, leader pipes and stand pipes, and the roof. This was the most complete maintenance program ever performed at the Terminal Pier. At the grain elevator, Port Authority contractors rehabilitated employee elevators, rebuilt explosion walls, added an automatic bagging facility, reconditioned all motors, and installed thermometers with remote reading capability in the large bins. During its first two years of operation, the Port Authority spent some \$900,000 on this work -- with Todd Shipyards Corporation paying part of the pier repair costs -- and at the same time paid off its debt to the state by selling bonds to bring the terminal under the same financial basis as other Port Authority projects (Port of New York Authority 1944-46 [primary sources]).

The new grain loading system, planned soon after the Port Authority took control but not executed until c1949-50, included removing most of the 1922 gallery conveyor system, and reactivating part of the original Barge Canal terminal plan by building a new pier directly south of the elevator with a shorter gallery. In the short term, the new grain pier was essential because use of the Terminal Pier by Todd Shipyards Corporation, operating from its large plant across Columbia Street in Erie Basin, precluded operation of the original grain conveyor galleries. The Port Authority had to lighter all its grain deliveries from the elevator before the new system was finished, reimbursed at least in part by Todd. For longer range planning, the new system served two ends simultaneously: it left both sides of the Terminal Pier with unrestricted use for general cargo handling; and it rationalized grain handling here by abandoning the unsuccessful shiploading facilities to concentrate on serving lighters which, with floating grain elevators, served the port's mixed liner cargo traffic. The new program included removal of galleries B, C, and D, the related tower north of the Terminal Pier, and the Navy Pier. A new pier about 580 by 60 feet, with asphalt-paved deck and concrete piles under the longitudinal center, replaced the older pier and supported a new grain gallery on a dense array of pile rows. Gallery A and the old tower at its end were now in line with the new pier. Modifications to the tower apparently included an inclined conveyor belt to move grain from Gallery A up some 55 feet to the 80 foot elevation of the new gallery conveyors. The new gallery included two parallel belts and seven delivery spouts, running along the entire east side of the pier. The Port Authority leased the west side of the new pier to cargo handling firms such as Pittston Stevedoring Corporation for receipt of lumber cargoes (Figure 6; Photograph 15; Army Corps of Engineers 1953; Port of New York Authority 1945, 1972 [plans]; Port Authority of New York and New Jersey 1944-46 [primary sources]).

With the end of the Todd Shipyards lease c1949, there were alterations made in the Terminal Pier preparatory to leasing the structure for general cargo handling. In 1950 and 1951, the Port Authority added a sprinkler system, new corrugated iron fire curtains in some roof trusses, and new supports, catwalks, and gratings for the cargo mast system (section II; Photograph 15).

Final Terminal Operations and Alterations, c1950-1974

Port of New York export grain volume continued to decline after World War II, a trend marked and exacerbated by the disappearance of over half the port's elevator storage facilities between 1925 and 1941. Elevation rate wars with the state during the pre-war period contributed to the demolition of all railroad elevators except the West Shore Railroad Pier 7 facility at West New York, NJ (HAER No. NJ-47). Around 1947, however, a new traffic in storage grain developed using idled Liberty Ships (National Defense Reserve Fleet) at Stony Point in the Hudson River. The vessels proved serviceable for long term storage, and were towed to the port for eventual export and reloading as needed, using floating elevators for transfers to export vessels. This system was a kind of extension of railroad grain storage in barges, canal boats, and rail cars, a pattern dating to the turn of the century. By 1946, the Port Authority succeeded in amending rail export rates to give the Gowanus Bay terminal equal status with other facilities, and the terminal participated in the Liberty Ship grain traffic for about fifteen years. By 1965, this somewhat uneven trade declined significantly, and the Port Authority ceased all grain operations at Gowanus Bay in September of that year, demolishing the second grain gallery and the older pneumatic unloader on the terminal bulkhead in 1972 (Army Corps of Engineers 1953, 1965, 1978; Anonymous n.d.).

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General cargo operations at the Terminal Pier continued through this period, with both cargo handling tenants such as Pittston Stevedoring Corporation, Jarka Corporation, and Jarka successor International Terminal Operating Company, and steamship company tenants such as Chilean Lines (serving parts of South America), Fern Lines (serving Europe, the Mediterranean, and East Asia), and Kawasaki, Kisen Kaisha LTD for a brief period in the 1960s. At least two tenants appear to have used the pier simultaneously in most years. Chilean Lines was the longest tenant, operating here for perhaps twenty years until c1974. The pier, known locally and officially as the Columbia Street Pier through the years of Port Authority control, also became the Chilean Pier to some because of this long tenancy. The Port Authority removed the semi-portals cranes c1951-56, and made one major alteration in 1967 by adding a large, gas-heated warm room at the northwest corner of the pier in a late attempt to counter the increasing obsolescence of break-bulk freight piers. In 1970, the terminal received its third official name, the Columbia Street Marine Terminal, acknowledging the more limited role of the site without its grain handling. By this time, however, containerization and related traffic losses in the port made the pier obsolete and difficult to lease, a problem exacerbated by increasing pile deterioration after some twenty years without major substructure maintenance. The last general cargo handling tenants left by c1974, since which time the pier and the remainder of the terminal have served largely for mooring of unused vessels (Part II; Port Authority of New York and New Jersey n.d. [primary sources]; personal communication, Derwood Hall, August 28, 1985).

Part II: Descriptive Information

General Character and Condition of Terminal Pier and Terminal

The original Gowanus Bay Terminal had five principal components: the Terminal Pier; the grain elevator, with associated administrative and power supply structures; the grain conveying galleries connecting the elevator and the Terminal Pier; the 'Navy Pier' or tie-up pier near the elevator; and the extensive bulkheaded upland. Federal development of the Red Hook Recreational Center c1938-40 covered approximately the northern half of the upland and the Henry Street Basin. Port Authority alterations c1944-55 removed most traces of the conveying galleries, all cranes on the Terminal Pier or the bulkhead, and the tie-up pier, while adding a new pier with a new grain conveying system along with repairs or minor alterations to the Terminal Pier. Later Port Authority actions, c1967-74, included adding a warm room to the Terminal Pier and demolishing the second grain conveying gallery.

Visually, this series of actions leaves the terminal with a generally strong sense of original development, except for the absence of the first grain conveying system, while presenting also the sequence of subsequent actions to the informed observer. The Terminal Pier, and the grain elevator with its outbuildings, retain refurbished, intact exteriors with original design elements, in original locations separated by the open expanse of the paved upland (Photographs 1 and 6). The surviving, now uncovered grain delivery pier built by the Port Authority suggests the former presence of the tie-up pier (originally, slightly to the west), but the later pier now contributes little to the significance of the present terminal except as the concrete pile components of the substructure indicate the former grain conveyor location. The interiors of the Terminal Pier and the grain elevator are essentially original, with the exception of the warm room at the northeast corner of the pier. In the elevator, only the removal/vandalization of electrical fixtures appears to modify the facility as completed 1922-25, although considerable debris and bird droppings contribute to the abandoned air of the structure. Openings in the tower southwest of the elevator indicate the former paths of both grain conveying systems (Photograph 6). The Terminal Pier is generally cleaner, and somewhat better maintained due to continued partial occupancy. Until recent work began at the terminal, associated with projected Port Authority construction of a fish processing center in Erie Basin, the complex was a largely unoccupied and unpoliced corner of the Red Hook section of Brooklyn, subject to a variety of informal and occasionally illegal uses.

Structurally, the Terminal Pier shed is in generally good condition, but parts of the wooden substructure and some column foundations have deteriorated significantly. Elsewhere in the terminal complex, the concrete bulkhead, grain elevator, and grain pier appear to be structurally sound, but the timber bulkheads in the Henry Street Basin north of the elevator are in poor condition (Dravo Van Houten 1984; Raber, Flagg, Parrott, Henn, Levin, and Wiegand 1984: 124).

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Terminal Pier Exterior

The pier projects out from the terminal bulkhead at an angle, so that the east side of the substructure and deck, at 1250.2 feet, is longer than the 1203.6 foot west side, with a uniform 150 foot width except near the north end of the pier. The single story shed is a rectangle 1184 by 108 feet, 36.8 feet high at the peak of the roof, with pier borders or aprons of 5 feet to the east, 25 feet to the south, and 39 feet to the west (Figure 6).

Substructure

Shed foundations consist of a 10.5 inch thick deck of reinforced concrete on wood piles 50 to 60 feet long and 14-16 inches in diameter. All but 6 of the 125 pile rows or bents, arrayed 10 feet apart, extend across the full width of the pier, with the first 6 bents of shorter lengths to accommodate the angle of the bulkhead. Incomplete historic plan data suggest the bulkhead immediately behind the pier was timber cribbing, to which pile row 1 attaches. The concrete rests directly on timber clamps running along either side of the pile heads in each bent. Pile supports were more closely spaced, and the concrete deck much thicker, along the western 39 feet of the pier beyond the shed, to support proposed railroad tracks which were never added. Photographs 20-22 show details of this wide track apron, along with other substructure details including the concrete supports for exterior shed columns (placed in alternate pile rows) and for both exterior and interior shed columns (in every fourth row), the concrete supports for the semi-portal crane rail at the west end of all bents, and the concrete fire walls extending to mean low water in pile rows 46 and 86. The finished concrete deck is 5 feet above mean high water, as is the terminal bulkhead--a standard height in the Port of New York at the time of construction (for additional plan data, see Photograph 27 and State of New York 1917: sheets 3 and 11 [plans]).

The state revised original contract specifications for Terminal Contract 55, during construction by Riverside Construction Company, to omit the scale pits shown in Photograph 21 and repairs to a nearby fragment of William Beard's 19th century Brooklyn Basin timber cribwork, and to change minor details including capstan settings (State of New York 1902-1921 [primary sources]). With these exceptions, Riverside apparently built the pier to original plans. There have been no changes in substructure design since construction, only repairs in kind. At least two ships collided with the pier during its construction, with damage repaired by Riverside, but available documentation reveals no further major mishaps or structural problems during the state's management of the Gowanus Bay Terminal. There were repairs to pier fenders made in 1927 and probably more extensive, but undocumented, repairs to the substructure in 1930; similar proposed maintenance work in the early 1940s was never done. During the first two years of Port Authority management, there was undocumented fender and pile repair work on the substructure along with reconditioning of the superstructure noted below. Port Authority photographs indicate additional undocumented repairs to the outer end of the pier in 1951, the last known maintenance work on the substructure (State of New York 1902-1921: Terminal Contract 55 [primary sources]; State of New York 1924-1931, Boxes 1-3: Maintenance Contracts 26, 65, 82, 86 [primary sources]; Port of New York Authority 1944-46 [primary sources]; Port Authority of New York and New Jersey n.d. [views]).

The substructure has suffered substantial deterioration during the nearly forty years since the last known general maintenance program, a condition already marked when the last general cargo handling tenants ceased operations here in the early 1970s. Recent survey revealed most piles retained less than half their original diameters, or were completely rotted through, while about 25 percent of the concrete in the column supports and the lower deck surface required replacement (Atlantic Diving Company 1983; personal communication, Derwood Hall, August 28, 1985).

Superstructure Exterior

Steel columns 30.4 feet high on the exterior and 35.4 feet high along the long central axis, placed over the substructure as shown in Photographs 24-25, form the vertical framing members of the shed. Each column has two channel beams riveted into a composite I-beam--1 foot square in the central row, 1 by 2 feet along the exterior--with a steel capped concrete base 1 foot high. The central columns in the north and south facades are similar but larger. Longitudinal and transverse steel trusses join the central columns, and span the shed at 20 foot intervals, respectively, defining 2 longitudinal bays, 59 exterior transverse bays, and 28 interior transverse bays south of the headhouse and control rooms described below. There are additional longitudinal trusses between alternate transverse trusses, 19.3 feet from either side of the shed. Steel beams .25 x .5 feet in section join the exterior columns horizontally and diagonally as shown in Photographs 8 and 17, and provide a framework for the corrugated, galvanized metal siding riveted to all exterior surfaces without doors or windows. Except for reconditioning of the column bases by the Port Authority in 1944-45, apparently including the addition of concrete above the steel base caps, structural framing elements remain in original form and in generally good condition; some concrete column bases are deteriorated. The Peerless Construction Company replaced the metal siding for the Port Authority in 1945, since which time the siding has remained generally intact with some weathering and collision damage (Port of New York Authority 1944-46 [primary sources]; Photographs 2-5, 23-25).

Metal covered wood cargo doors, with steel interior reinforcement, define the east and west shed elevations south of the headhouse. On the west side, intended for barge unloading, there are 28 doors in alternate bays, each in two vertically sliding sections covering an opening 18 feet wide by 16 feet high. The 56 eastern doors, each with three vertically sliding sections, cover openings 18 feet wide by 20 feet high in continuous bays. Original plans called for wicket door built into 8 of the cargo doors, but it is not clear if final designs included this feature (Photographs 24-25). Manually operated chains worked each door section. The greater ease of adjusting barge locations to door locations, relative to steamship lengths, probably explains the lack of continuous doors on the western side. Two doors of similar composition, each with two vertically sliding sections covering an opening 16 feet wide and 15 feet high, open the center of the outshore shed end. In a comparable position on the inshore facade, two wood doors swung overhead revealing entrances 14 feet wide and 13 feet high. Each swinging door had three 4 by 4 windows over six recessed panels, an arrangement reflected in the facade described below. In 1945, the J. Edward Ogden Company repaired the 88 cargo doors on the pier; all cargo doors remain intact with at least some still operable (Port of New York Authority 1944-46 [primary sources]; Photographs 1-5, 7-9, 11).

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Original shed design included matching both end facades in sheet metalled, classical corner pilasters and pediments, with flag poles on low finials. As indicated in Photographs 2, 11, and 23, state planners had Snare & Trieste complete the outshore facade as planned, but modified the inshore facade above the windows by substituting horizontal for inclined lines, restricting the pediment with its single flagpole--since removed--to the central third of the facade above the doors, and adding somewhat ungainly finials above the corners. The modifications, which included increasing window sizes and redesigning the overhead swinging doors to match the windows immediately above, evidently occurred prior to shed construction. The inshore facade has two 4 by 7.5 foot hinged doors, originally sporting canopies; a third 3 by 7 foot door enters the west side of the headhouse. The Port Authority removed the canopies and replaced these original exterior hinged doors, of undocumented material, with hollow metal doors in 1967. Multi-paned windows with horizontally hinged swinging sections divide the inshore facade into six equal sections--including the overhead doors--and turn the inshore corners to define the limits of the headhouse. Three sets of small 4 pane windows on the west facade, each with three windows abreast, lit the three stevedores' toilets noted below for the interior, and complete the shed exterior wall openings. All exterior windows survive in original arrangements, but most of the panes are broken (Photographs 1-4, 11-12).

When first completed in 1921, the exterior had a uniform coat of dark paint, color unknown, and light colored lettering on the end facades. Inshore, the words **NEW YORK STATE CANAL TERMINAL** extended across the architrave beneath A.D. 1921 centered under the pediment peak; the outshore end, not visible in currently available photographs, probably had **NEW YORK STATE CANAL TERMINAL**, flanked by **GOWANUS BAY** in smaller letters within the same horizontal plane, above the doors. The Port Authority repainted the shed at least once, in 1944, and replaced the lettering on each facade with **COLUMBIA STREET PIER/ THE PORT OF NEW YORK AUTHORITY**. No paint survives on the long sides of the pier. What was probably gray paint with blue trim is visible on the facades, with the lettering in black. Weathering of the Port Authority paint has revealed some original lettering on the inshore end (Photographs 1-4, 11-12, 23).

Steel channel beams above the shed trusses form a network of purlins, supporting wooden roof boards. A slag surface finished the original roof, partially replaced in 1967 by a composition finish. There are four 5 by 10 foot skylights centered in each transverse bay. Original galvanized iron ventilators, each 2 feet in diameter, punctuate the roof peak at staggered 40 foot intervals. Galvanized steel downspouts drain the roof, running down alternate exterior shed columns along the east exterior and west interior of the shed walls. Aside from the 1931 addition of skylight screens, undocumented roof and downspout repairs made by the Port Authority in 1945-46, and the 1967 roofing replacement with additional repairs to the downspouts, the roof is intact with largely original design elements. There is some deterioration of wood roof boards and skylight frames. The roof also retains substantial remains of original cargo handling equipment, discussed below (Port of New York Authority 1944-46 [primary sources]; Photographs 1, 5-7, 23-25).

Terminal Pier Interior

The original interior was a completely open cargo space, beyond the headhouse at the inshore end, with a 2.25 inch asphalt block surface above the concrete pier deck. Interior travelling cranes planned for the shed were never installed. To protect the walls from damage by forklift trucks and other wheeled equipment required to move cargo along the floor, original construction included open, 12 foot high arrays of 2 by 6 boards between the western cargo doors. Three identical 8 foot high concrete walled structures, each 8 by 15 feet at 400 foot intervals along the west wall, housed stevedores' toilets and small store rooms. Metal ladders next to each toilet door give access to the roof through small scuttles. Six additional metal ladders along central columns give access to the elevated water pipes noted below, but do not penetrate the roof. Original interior construction included 5 foot high corrugated steel firewalls below the upper chords of three trusses, spaced 280 feet apart beginning 370 feet from the inshore pier end. The Port Authority added four additional corrugated steel firewalls in 1950, covering all of the trusses 140 feet on either side of the original firewalls, when the additional sprinkler protection noted below was added. All of these original and modified features of the open interior cargo space remain substantially intact, although the original colors dividing the space vertically are now replaced by a uniform gray (Photographs 7-9, 17-19, 23-25).

There are two sets of interior enclosed spaces: the original two story headhouse surrounding the inshore pier entrance, and the adjacent warm room added by the Port Authority near the northeast corner of the interior in 1967. The asymmetrical headhouse first floor, elevated in most places on 6 inches of concrete above the pier deck along with the driveway divider at the inshore facade center, contained space for offices, switchboards probably controlling all pier electrical systems, coal fired boiler and heating apparatus for the entire headhouse, and an undocumented battery room probably controlling the semi-portals cranes discussed below. Cement plastered tile defines all outside and first floor interior headhouse walls, with stud interior partition walls on the 18 foot wide second floor extending across the pier for toilet and additional office facilities. Photographs 26-27 show headhouse arrangements, along with interior door, ceiling, and floor modifications made by the Port Authority in 1967. Most accessible headhouse spaces, all of which are now on the second floor, today have artificial wood paneling, but the corridor ending at the utilitarian, wood bannistered stairway retains two-tone green painted walls which may survive from original construction. Original plans show access to the second floor only at the west side of the headhouse, but a metal stairway today enters the second floor near the upper headhouse southeast corner. The latter stair is probably original (Photographs 9 and 27).

Port Authority engineers appended the warm room--an insulated, gas-heated 300 by 53 foot space designed to preserve perishable cargo--to the existing shed by adding steel columns under trusses between original interior centerline columns, bracing the original and new columns, and attaching corrugated steel siding to the steel framework and timber sills. The undivided enclosure rises to the roof, retains original pier asphalt flooring, and has three steel roll-up doors, each 18 feet wide by 14 feet high, on the south and west sides. The warm room remains intact, and is today the principal part of the pier used for storage and repair operations by the Kosnac Floating Derrick Company. Outside the enclosure, unused roll-up doors from other Port Authority sites lie along the west side of the shed (Photographs 7-9, 28-29).

Original shed design included a water supply system through the full length of the structure, hung from the lower truss chords. It is not clear if the system was for fire protection or supply to vessels, but later data indicate the completed utilities included only a short standpipe system ending at the headhouse for hook-up with municipal firefighting equipment (Army Corps of Engineers 1926, 132, 1942). The Port Authority added a compressed air, dry-pipe sprinkler system--still functional--throughout the shed in 1950, providing the first extensive fire protection system at the pier (see Port of New York Authority 1950 [plans] for complete details). Plumbing for the pier's six toilets, four lavatory sinks, and shower; the coal fired radiator headhouse heating system; and largely undocumented electrical systems tied to a 10 by 20 foot transformer house northwest of the pier, completed original built utilities. Three suspended lights in each open transverse bay supplemented the skylights. The 1967 Port Authority modifications included addition of mercury vapor fixtures for the warm room and wiring changes in the headhouse (Port of New York Authority 1967 [plans]; Photographs 7-9, 17-19, 24-27).

Terminal Pier Handling Equipment and Operations

As originally completed, the Terminal Pier had three principal handling equipment systems: the semi-portal cranes intended primarily for barge unloading on the west side; the cargo masts for ship loading on the east side; and the end of the grain conveying system--Gallery D--for ship or barge loading on the east side. Two 1140-foot steel rails, one at the edge of the west pier apron and one suspended on the west shed wall about 18.5 feet above the deck, supported the two cranes. Each 3-ton crane had a 40-foot fixed radius revolving jib, with three separate Western Electric crane type CO 1808 motors for separate actions of hoisting, slewing or rotating, and traveling along the pier, at maximum respective speeds per minute of 120, 360, and 150 feet. The semi-portal frames were made of steel girders, and the rotating operators' houses were of sheet steel. Ladders and attached stairways gave operator access from the pier deck or the shed roof. Canal planners evidently intended the cranes, with motors rated for half hour duty, for unloaded travel to moored barge locations and cargo movement from a barge to the nearest cargo door for storage in the shed interior. Pier operators quickly dispelled such notions by using the wide apron for short term storage and the cranes for traveling with heavy loads under continuous duty, in part to load ships. In April 1924, one of the traveling motors burned out while shiploading crated automobiles. The crane contractor arranged for a repair of this motor, and state canal managers considered replacing the motors with heavier, continuous duty models. In light of insufficient business at the terminal, however, such a change was never made; terminal managers instead forbid load carrying along the pier. Available records do not indicate any later changes made to the cranes. With the anticipated general cargo canal barge traffic never very heavy, it is likely that the cranes were more important in loading and unloading ships. There is no record of Port Authority crane maintenance; photographs suggest the cranes were removed c1951-56, with subsequent cargo handling on this side handled only by undocumented wheeled equipment (New York State 1910-1944, Box 39: Terminal Contract 118 [primary sources]; New York State c1902-1921: Terminal Contract 118 [primary sources]; Photographs 2, 4, 13, 16, 24-25).

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The 1120-foot-long cargo mast system on the east side rose about 28.5 feet above the east edge of the shed roof, for a total height above the pier deck of some 59 feet. Composite, 1-by-.5-foot steel I-beams riveted to shed columns and truss corners form the vertical supports or cargo masts, with braces extending back 20 feet to flanged connections with upper truss members. Parallel steel beams above the braces support a 2-foot-wide grated metal catwalk surrounded on all but the east side by a welded railing of round steel bars. Continuous steel girders, 1.75 feet wide and attached to steel flanges projecting 1.5 feet east of the mast tops, run the full length of the system with 1-foot-diameter steel rings hanging from the girders over the center of each transverse shed bay. Photographs indicate that Port Authority replacement of the girders, catwalk, and railing in 1950 reproduced the original cargo mast structure, so that the cargo handling system here was the same throughout the active history of the pier. Known as burtoning, this system involved hanging pulley blocks from rings at desired locations, attaching independent lines to cargo in slings from both the cargo mast pulleys and pulleys on ship booms, and maneuvering cargo between ships' hatches and pier cargo doors. This system freed some ships' booms for other work, and allowed ships to breast off the pier with room for coal barges or lighters to work ships while burtoning proceeded. Since the Terminal Pier apparently had no winches or other lifting equipment on the east side, burtoning here must have involved manual hoisting from the catwalk and reliance on ships' winches for as much power and maneuvering as possible. The system survives substantially intact, with serious damage near the outshore end from a container ship collision (New York, New Jersey Port and Harbor Development Commission 1920: 380-81; Port Authority of New York and New Jersey n.d.: vol. 2; Photographs 1, 5-6, 11, 14-15, 23-25).

Grain gallery D, 700 feet long from the inshore pier end, rose another 34 feet above the cargo mast system, reaching a height of about 93 feet above the pier deck. Two ships could load grain here simultaneously. The gallery supports were built onto those of the cargo masts, with similar composite steel I-beams above the cargo masts and attached to the flanges at the base of the cargo mast braces, so that the gallery was about 20 feet wide. A steel framed, corrugated iron sided framework about 11 feet high enclosed the double row of 42-inch-wide belt conveyors, lit by small windows on either side of the gallery over alternate transverse shed bays. Twelve flexible spouts could reach ships or barges from the underside of the gallery, probably fed by movable unloaders or tripping mechanisms emptying the conveyor belts. Electrical push-button controls in a small house 200 feet south of the inshore end of Gallery D regulated the feed from the reserve bins and lofters in the tower at the end of Gallery C; the gallery operator could also communicate in some way with the feed tender at the elevator shipping bins. Gallery D had an aggregate loading capacity of 25,000 bushels per hour. NEW YORK STATE CANAL GRAIN ELEVATOR appeared on both sides of Gallery D, through at least two generations of paint shown in historic views. No original plans of the structure survive, and only fragments of the vertical members at the cargo mast braces mark the location of the demolished grain handling facility on the Terminal Pier (State of New York 1923: 26; Photographs 11-14).

Part III: Sources of Information

Plans and Drawings

The State of New York transferred all known original drawings of the Gowanus Bay Terminal to the Port Authority of New York and New Jersey some years ago. Searches and inquiries at New York State Archives and the New York State Department of Transportation, Waterways Division suggest this transfer, and recent destruction of some Barge Canal records, make the Port Authority the sole holder of drawings for its own Gowanus Bay projects as well for original construction. Asterisked items in the list below are included in photographs made for this documentation of the Terminal Pier.

Original Construction of the Terminal

A. The Terminal Pier

State of New York

1917 Terminal Contract No. 55/Gowanus Bay/ For construction of a Barge canal Terminal pier at New York. Originally 16 sheets; nos. 1-11 are at Port Authority offices, nos. 12-16 appear to be missing.

1. Site Plan and Index of Sheets
2. General Plan
3. Deck and Pile Plans
- *4. Typical Pile Rows and Fire Wall Details
- *5. Details of Row No. 7, Capstan Foundations & Horizontal Brace Connections at Row No. 1
6. Details of Outer Rows and Corner Fender System
- *7. Detail Sections of Footins & Trough for Railroad Tracks
8. Longitudinal Sections and Side Elevations
9. Timber Clamps and Framing
10. Detail Sections of Concrete Deck and Capstan Recesses
11. Plan and Details of Deck Reinforcement
- (12. Scale Pit Details)
- (13. Fender System)
- (14. Metal Details)
- (15. Details of Capstan Covers and Scale Pit Frames)
- (16. Crane Rail Details)

1920 Terminal Contract No. 219/Gowanus Bay/For constructing a Barge canal terminal piershed at Gowanus Bay, Brooklyn, New York City. Series is incomplete.

1. General Location Plan
- *2. End Elevations and Cross Section
- *3. General Plans, Elevations and Sections/Rows 5 to 65
- *4. General Plans, Elevations and Sections/Rows 65 to 123
- *5. First Floor Plan of Headhouse

B. The Grain Elevator

State of New York

- 1921 Terminal Contract No. 81/Gowanus Bay/For constructing and equipping a grain elevator....at Gowanus Bay, Borough of Brooklyn, New York City. Incomplete set; not reviewed in detail for this documentation.

State of New York Repairs

State of New York

- 1942 Contract No. M-86/Repair to Barge Canal Terminal Pier. 1-sheet set showing repairs needed at outer end.

Port Authority Terminal Modifications

A. The Terminal Pier

Port of New York Authority

- 1950 Columbia Street Pier/Sprinkler System. Contract GT-20
1. Location Plan and Index
 2. Mechanical Installation
 3. Mechanical Installation/Sections and Details
 4. Electrical Installation
 - S-1. Unit Heaters and Controls
- 1967 Grain Terminal/Columbia Street Pier/Alterations and Repairs to Pier Shed. Contract No. GT 120.003
- *1. Office and Roof Details
 - *2. Warm Area-Plan and Details
 - *3. Partition Framing and Details
 4. Mechanical
 5. Electrical
 6. Electrical - Second Floor Plan and Panel Schedule/Transfer
 7. Electrical One Line Diagram

B. Grain Pier

Port of New York Authority

- 1945 Piers and Foundations for Shipping Gallery. Contract No. GT 120.006. Not reviewed in detail for this documentation.
- 1972 Demolition of Grain Elevator Gallery. Contract No. GT 120.006. Not reviewed in detail for this documentation.

These drawings are available for inspection at Port Authority offices, and will be kept on file for at least fifty years. Longer retention is possible by request. Contact:

Port Authority of New York and New Jersey
One World Trade Center
New York, NY 10048
ATTN: Mr. Nicholas Manicone (212/466-8006)

Historic Views

There are two principal collections of historic views: New York State Archives and the Port Authority of New York and New Jersey. New York State Archives is currently processing once scattered, recently gathered collections of Barge Canal material, and may in the future locate more photographs than were available for this documentation.

State of New York

cl905-21 Barge Canal Construction Photographs. Series 501, Accession Nos. 336-77 and 336-85. 336-77 includes Box 7, Terminal Contracts 55, 79, and 81. There are 27 views of Terminal Contract 55 (some reproduced for this documentation), 9 views of bulkhead construction in Terminal Contract 79, and 21 views of elevator foundation work in Terminal Contract 81. 336-85 includes Box 12, Miscellaneous Contracts. There are 50 views of Terminal Contracts 219 and 81 made 1921-22 (some of which are reproduced for this documentation) of piershed and grain gallery construction.

Port Authority of New York and New Jersey

n.d. 5 volumes of photographs show the terminal cl944-67. This documentation reproduces four of the hundreds of available views.

Useful general published views appear in Whitford 1922 and Army Corps of Engineers 1932, with some additional details shown in State of New York 1914-26. It should also be noted that the former Gowanus Bay Terminal is located at what was once an extremely busy and much photographed part of the Port of New York. In addition to the relatively few known published views of the terminal and the archival sources listed above, there are probably many views in newspapers, private or local museum collections, and publications on subjects not reviewed for this documentation.

Interviews

1. Daniel Lorello
New York State Archives
Office of Cultural Education, State Education Department
10A46 Cultural Education Center
Albany, NY 12230 518/474-1195

Interviewed August 1985. Mr. Lorello is currently in charge of accessioning recently collected Barge Canal materials, and is the best source for all Barge Canal holdings in the state archives.

2. Derwood Hall
Port Authority of New York and New Jersey
One World Trade Center
New York, NY 10048 212/466-7968

Interviewed August 1985. Mr. Hall has personal administrative experience with the former Port Authority Grain Terminal, and is currently the best source for access to documentary material on the complex.

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Likely Sources Not Yet Investigated

In addition to potentially myriad undiscovered photographs noted above, there are several additional documentary sources with possible information. Correspondence and other files of the former offices of the New York State State Engineer and Surveyor, and the New York State Superintendant of Public Works, may yield material on Gowanus Bay Terminal design, construction, maintenance, marketing, and economic performance issues. These records are in New York State Archives. Port Authority files may contain similar information. A complete search of contemporary engineering or grain-trade-related journals may provide fuller context on early 20th century conditions at various North Atlantic terminals; there is no history of the grain trade in this period. Newspapers covering the Port of New York could contain summaries of all these data.

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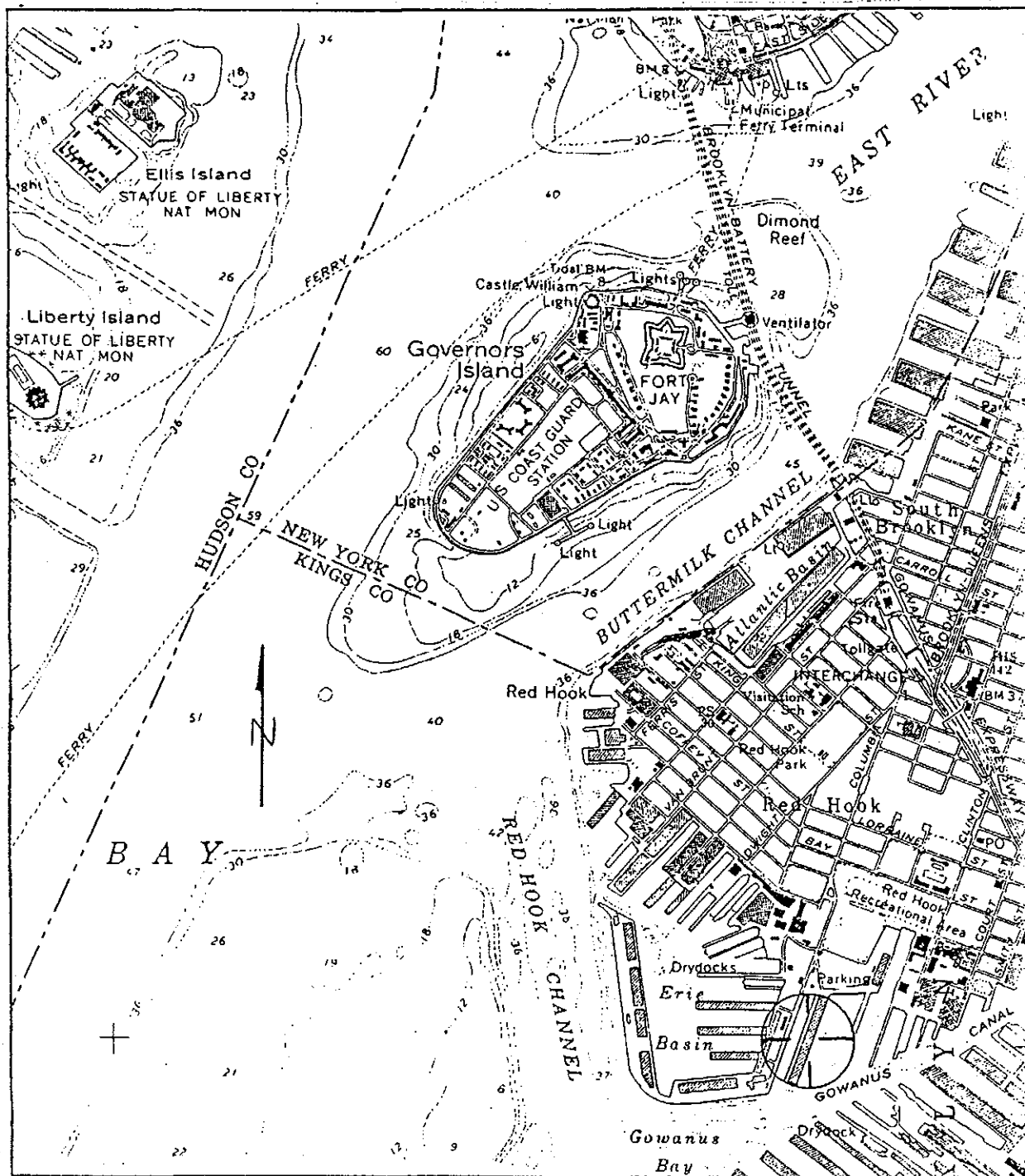


Figure 1. TERMINAL PIER LOCATION IN UPPER NEW YORK BAY

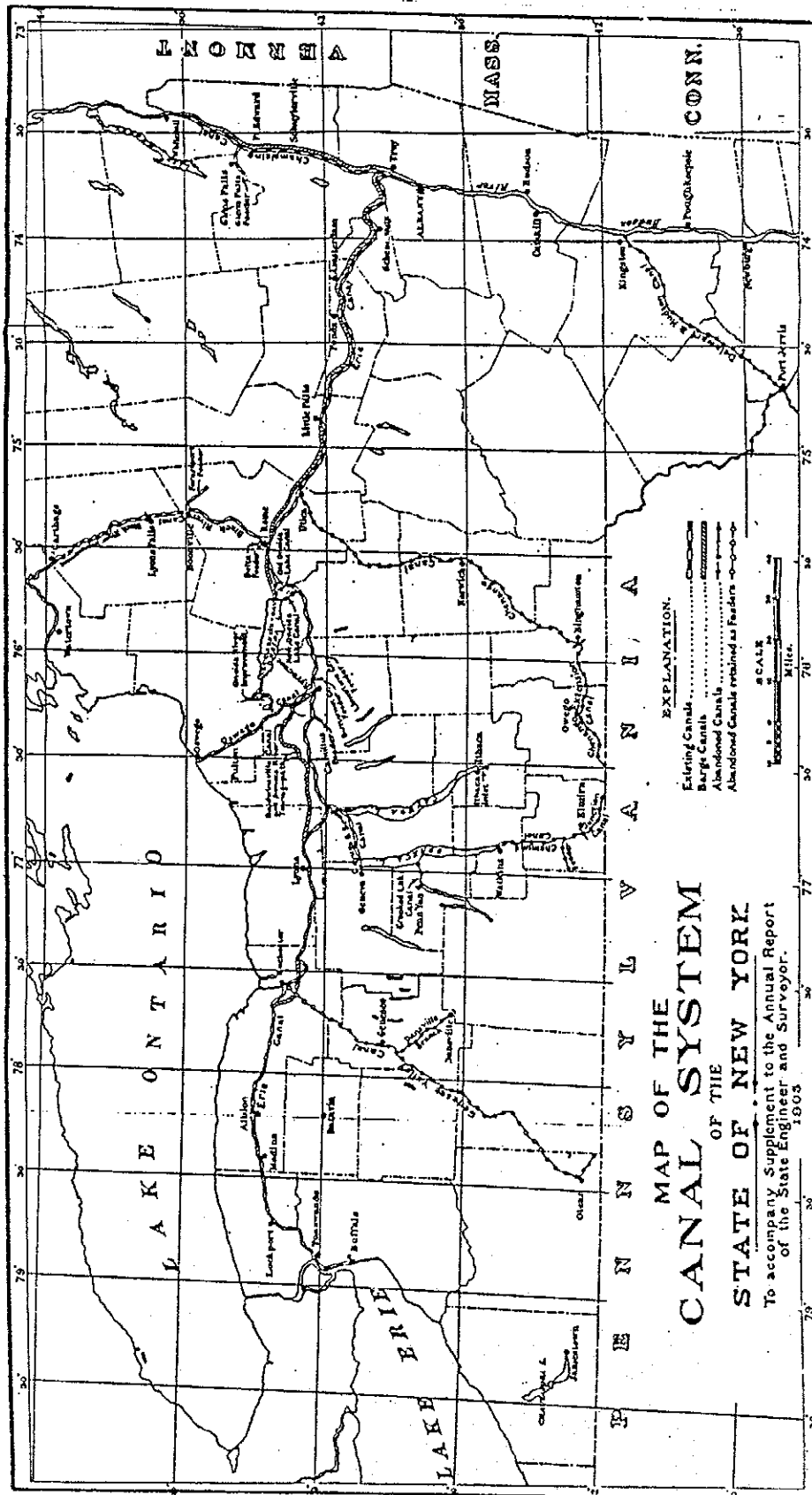
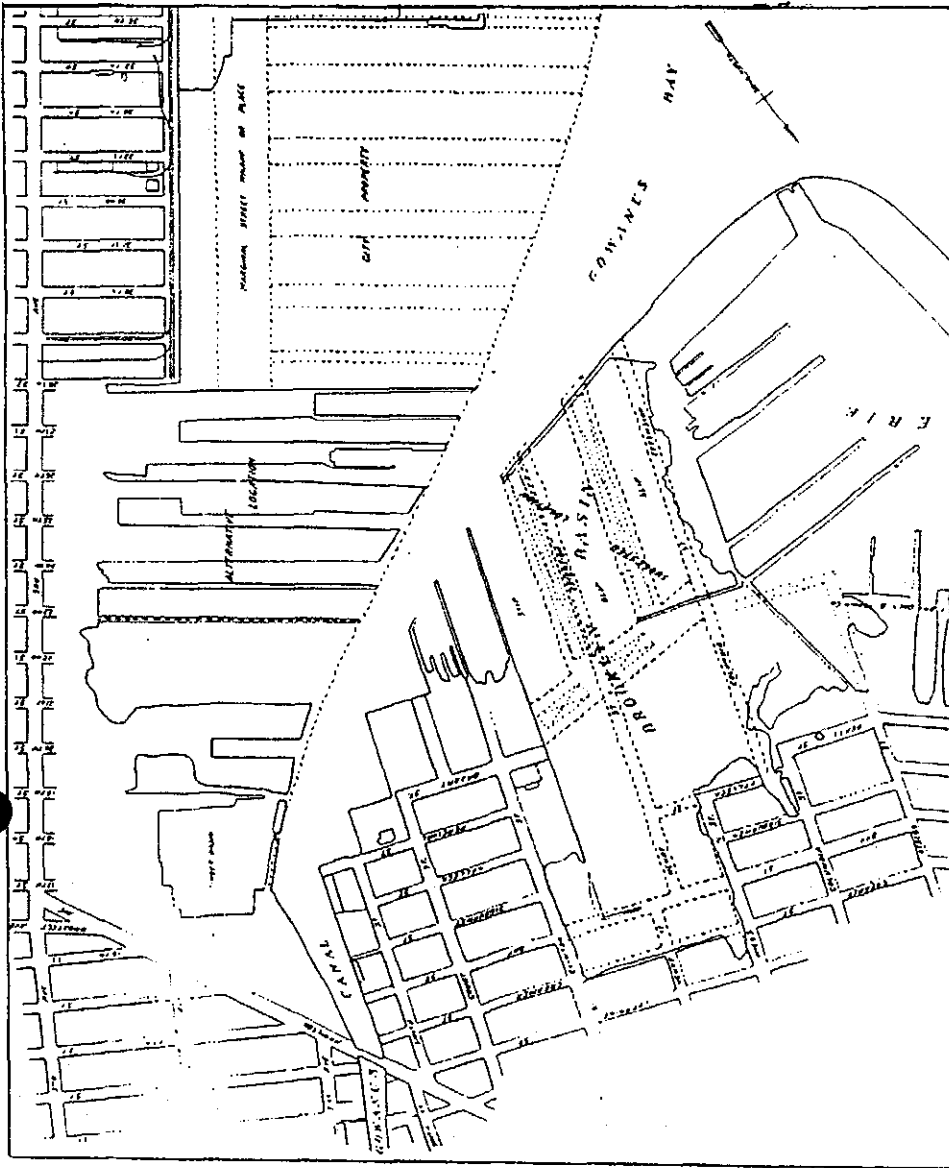


Figure 2. EXISTING AND PROPOSED NEW YORK STATE CANAL SYSTEM IN 1905

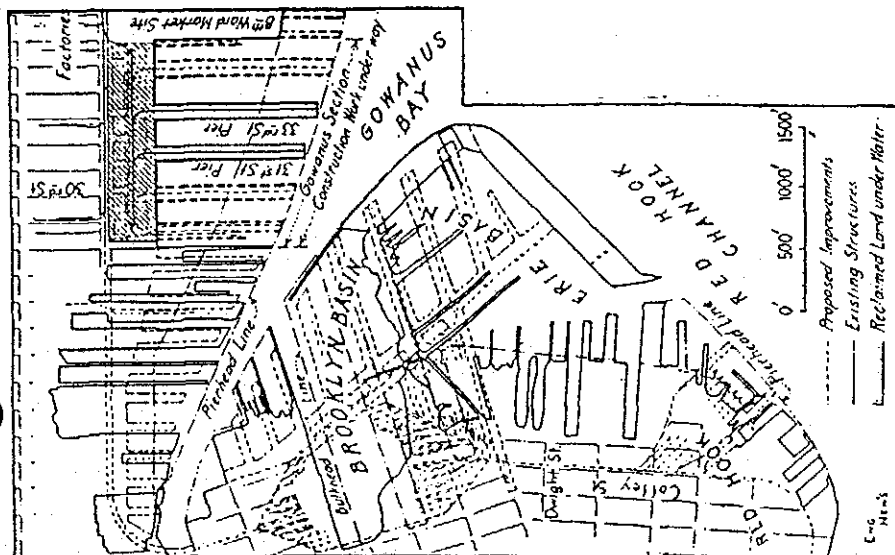
Source: Whitford 1906

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BARGE CANAL TERMINAL COMMISSION PLAN - 1911

Source: State of New York 1911



NEW YORK CITY PLAN - 1906

Source: Staniford and Guise 1912

Figure 3. COMPARISON OF GOWANUS BAY DEVELOPMENT PLANS

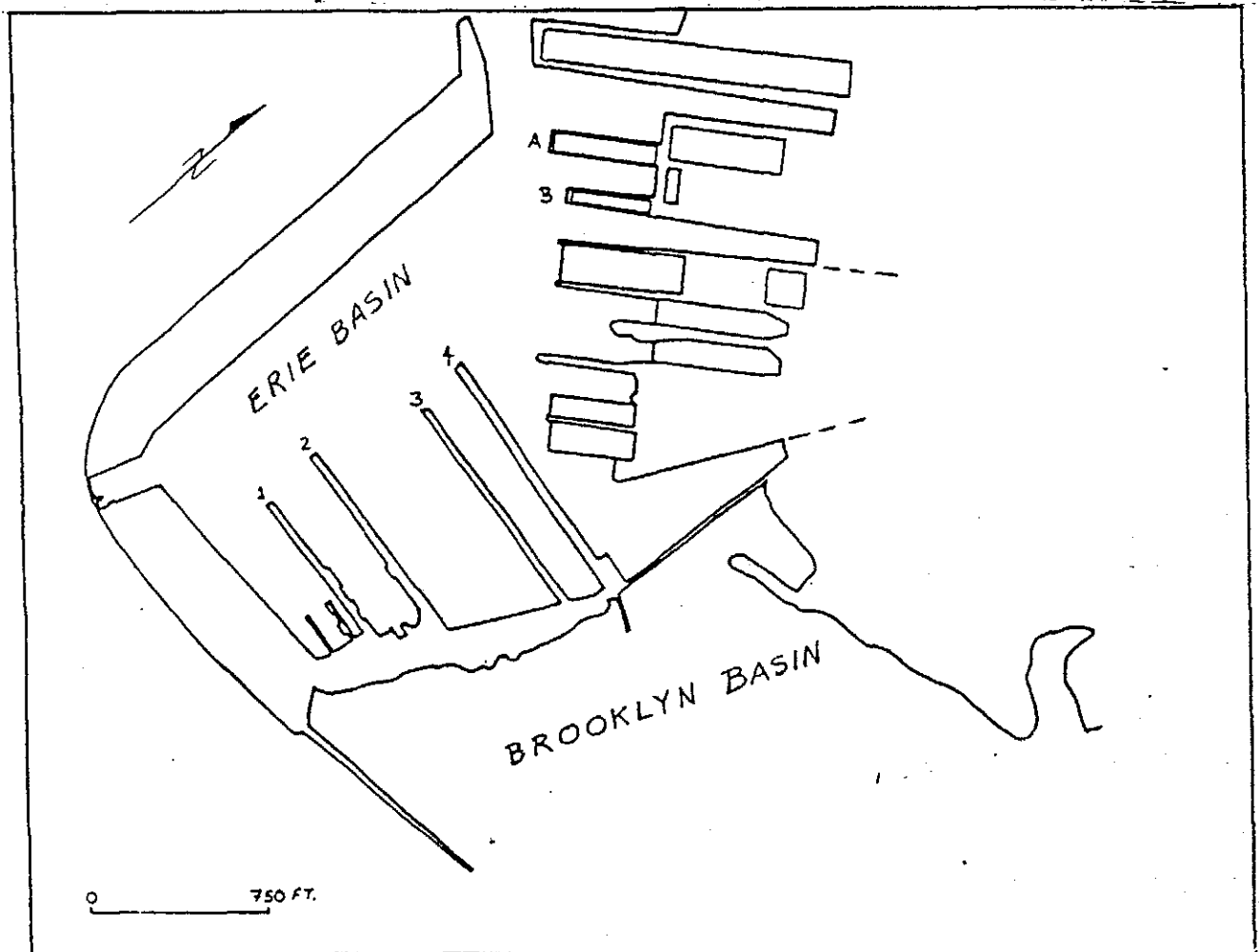


Figure 4. ERIE AND BROOKLYN BASIN VICINITY c1910

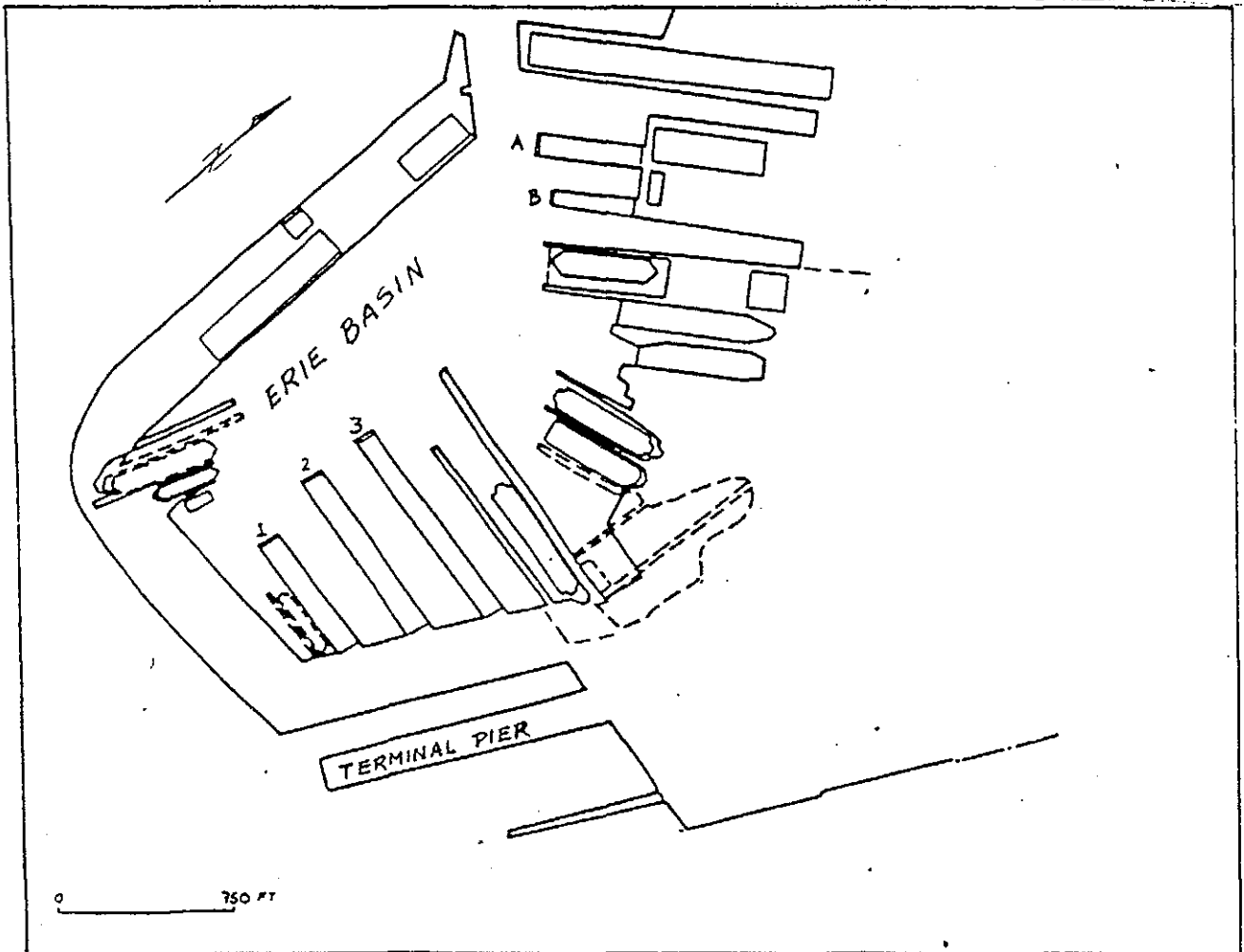
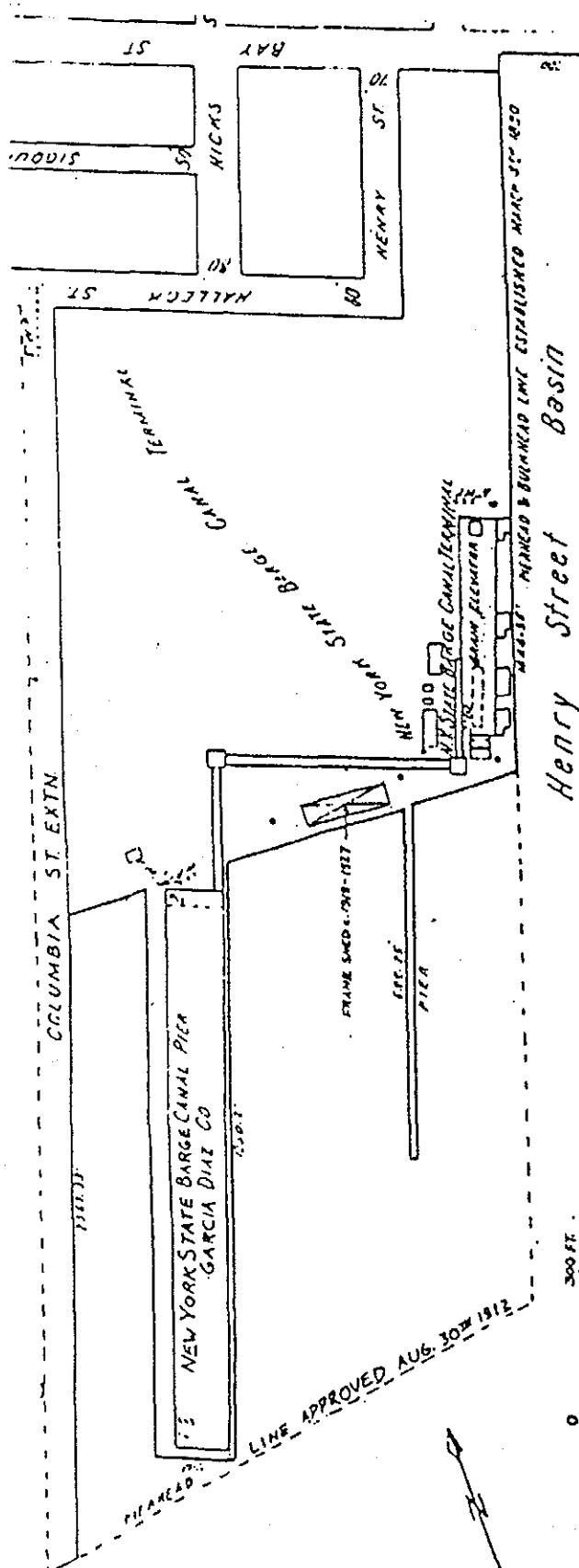
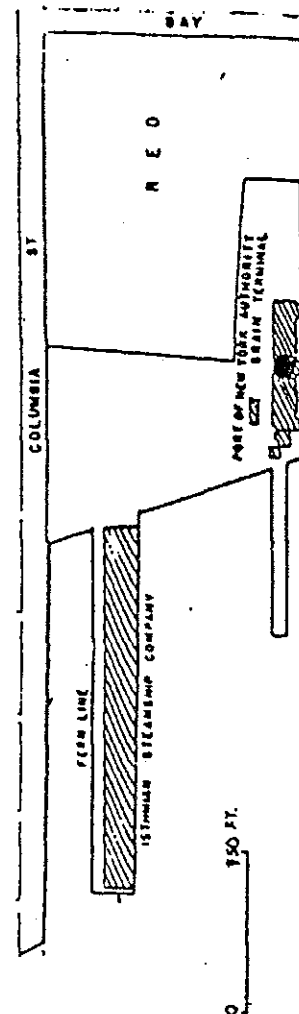


Figure 5. ERIE BASIN VICINITY AND GOWANUS BAY TERMINAL c1925

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1928



1953

Figure 6. TWO STAGES OF GOWANUS BAY BARGE CANAL TERMINAL DEVELOPMENT
sources: Sanborn Map Company 1928
Army Corps of Engineers 1953

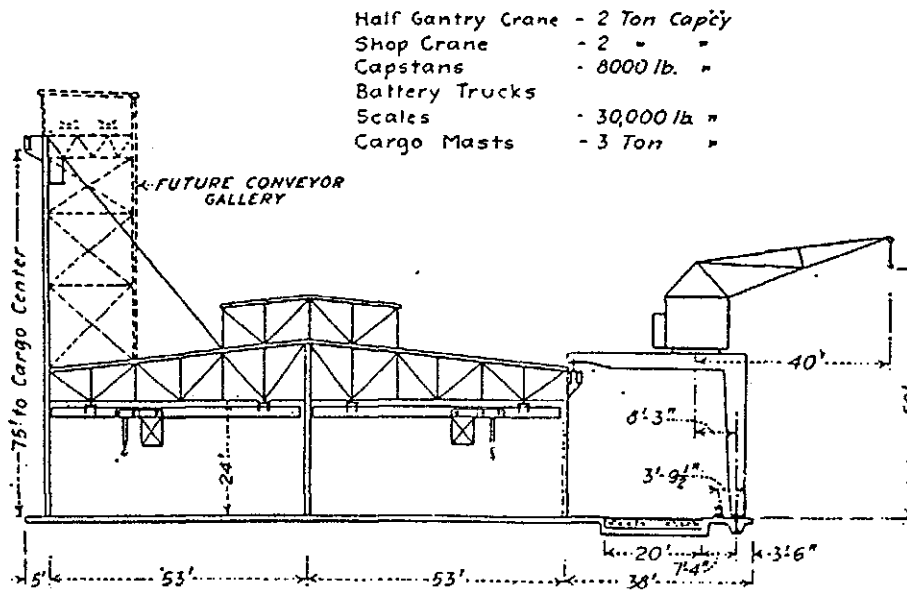


Figure 7. SKETCH OF EQUIPMENT ORIGINALLY PLANNED FOR TERMINAL PIER, c1920
 Source: MacElwee 1926: 139

As built dimensions of completed equipment do not match this sketch. The semi-portal cranes were set lower on the side of the shed. The cargo masts were lower, and the grain conveyor gallery higher, than shown.

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KEY TO PHOTOGRAPHS

